Chemical Bonding and Reactions

PS-4 The student will demonstrate an understanding of chemical reactions and the classifications, structures, and properties of chemical compounds.

PS-4.7 Summarize characteristics of balanced chemical equations (including conservation of mass and changes in energy in the form of heat—that is, exothermic or endothermic reactions)

Taxonomy Level: 2.4-B Understand Conceptual Knowledge

Key Concepts:
Chemical equation: Balanced equation
Conservation of mass
Energy change : Exothermic, Endothermic

Previous/Future knowledge: Students in the 7th grade explained how a balanced chemical equation supports the law of conservation of matter (7-5.8). This is the first time students relate chemical equations to energy change occurring in a chemical reaction.

It is essential for the student to

- Understand that a *chemical equation* uses chemical formulas and symbols to show the reactants and the products in a chemical reaction.
- Understand that a *balanced chemical equation* represents the process of a chemical reaction where atoms are rearranged but not created or destroyed.
  - The equation shows that the same atoms that existed before the chemical reaction (in the reactants) are still there after the reaction (in the products).
  - Mass is conserved; the law of conservation of mass states that the mass of all substances that are present before a chemical change equals the mass of all the substances that are remaining after a chemical change.
- Understand that there is always an energy change when a chemical reaction occurs.
  - If heat is given off it is called an *exothermic* reaction. This type of reaction releases heat to the area around the reaction, so this area will become warmer.
  - If heat is absorbed it is called an *endothermic* reaction. This type of reaction takes heat from the area surrounding it, so the area around the reaction will become cooler.

If is not essential for the student to

- Predict whether a reaction will be endothermic or exothermic or give reasons why;
- Calculate heat released or absorbed.

Assessment Guidelines:
The objective of this indicator is to <u>*summarize*</u> the concepts involved in balanced chemical equations including conservation of mass and endothermic or exothermic reactions, therefore, the primary focus of assessment should be to generalize major points about balanced equations in the context of conservation of mass and changes in energy.

In addition to *summarize*, assessments may require that students

- <u>*Compare*</u> endothermic and exothermic reactions;
- <u>*Infer*</u> that endothermic or exothermic reactions have occurred given evidence (such as the container the reaction occurs in becomes cold.); or
- <u>*Exemplify*</u> characteristics of reactions.